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| **Title:** | Design, Simulation, Building, and Testing of a Microcontroller-Based Automatic Drowsiness Detection, Vehicle Braking, and Alert System | | |
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| **Abstract:** |  |
| Aims: The premier practical aspect of this research drive is to propose, build, simulate, and evaluate an Arduino-built automatic vehicle driver drowsiness detection and alert system.  Study Design: The pivotal role of a reliable braking system in vehicular safety cannot be overstated, particularly considering the escalating frequency of traffic accidents, notably prevalent in Indonesia where human factors take center stage as the primary accident catalyst. An insightful poll underscores physical fatigue or drowsiness while driving as the foremost concern. Acknowledging the nuanced disparities between conventional air systems and electric systems, this research strategically directs its attention toward crafting a new system characteristic that mirrors the efficiency of the existing systems.  Place and Period of Study: The research action engaged by the authors in a bunch of two students under the command of a professor as a part of one of his course capstone projects for the Bachelor of Science in Electrical and Electronic Engineering degree at the American International University Bangladesh (AIUB), Dhaka, Bangladesh. The authors performed their investigative tasks at AIUB from June 2023 to January 2024.  Methodology: Recognizing the imperative to fortify vehicular safety, the integration of artificial intelligence emerges as a vital solution to assist drivers in ensuring the safety of individuals both within and outside the vehicle. This focused study, tailored specifically for Electric Vehicles (EVs), centers on the innovative application of object and distance identification methodologies to provide a comprehensive braking action indicator. Leveraging a minicomputer and a sophisticated neural network approach, images captured by a stereo camera undergo meticulous machine learning processes. This facilitates the precise categorization and measurement of distances between objects, with subsequent priority decisions determining the optimal degree of braking action. Employing an intelligent methodology, specifically fuzzy logic, the study demonstrates a successful outcome by constructing a curve while concurrently enhancing the dynamics of the pre-existing system. Moreover, a finely tuned Pulse Width Modulation (PWM) signal for braking, lasting 10 milliseconds, is intricately devised based on the study's discerning results.  Results: The system is simulated in Proteus and tested in real time to check its functionality. The outcomes of the test showed that the system can produce the appropriate signals based on the detection of any kind of driver’s drowsiness and can stop the car.  Conclusion: This comprehensive approach ensures the seamless replacement of components while concurrently elevating the overall performance of the braking system. | |